TREPHINING FOR EXTRA-DURAL HÆMORRHAGE.[1]

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APPARENTLY much has been done in the past two years in brain surgery, but by far the greatest number of operations and reported successes have been for focal or Jacksonian epilepsy. In this class of cases the immediate results have been good, but can we say this of the remote? No; and therefore in my judgment beyond giving temporary relief, or beyond holding the trouble in abeyance for a time, these operations have accomplished most in demonstrating the amount of manipulation the brain is capable of permitting, providing that this is done by skilled hands and that every possible antiseptic precaution be taken. The lateral ventricles have been tapped, but this offers no more than temporary relief. It does not by any means remove the factor, which is slowly, but surely, killing the patient. This is true to a great extent in the cases of tumors, as we know the most common forms of brain tumors are tubercular, sarcomatous, and syphilitic, and therefore in the event of their successful removal the patient is not restored to a normal condition, but is left crippled. More favorable results have been obtained in tumors springing from the dura mater or agglutinated membranes, which are not strictly tumors of the brain substance, but invade it by pressure, exeavating for themselves a bed or nest. Contrast with the above, trephining for intra-cranial hæmorrhage, particularly of the extra-dural variety. Here the operation, if done early, is in every sense a life-saving agent, practical as well as permanent in its results in the majority of cases.

We have four varieties of intra-cranial hæmorrhage:

1. Where the blood finds its way between the

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inner wall of the cranium and the dura mater. 2. Where it finds its ways into the sub-dural space. 3. Where it finds its way into the sub-arachnoid space and into the meshes of the pia mater. 4. Where it escapes into the substance of the brain or into its ventricles.

Erichsen gives the third variety as the most common form of intra-cranial hæmorrhage, while Prescott Hewitt gives the second variety as the most common. In the cases which I report to-night, and in which I trephined, all were of the extra-dural variety. When blood is poured out between the dura mater and the bone in cases of fracture, the vessel or vessels that are, as a rule, torn, are the middle meningeal artery or its branches. Mr. Jacobson has shown that the branches of this artery are more frequently ruptured than the trunk. The vessel is very frequently torn at the point where it crosses the anterior inferior angle of the parietal bone. The reasons for this are: 1. The bone at the site of the groove for the artery is very thin. 2. The vessel is so frequently buried in the bone that fracture without laceration of the vessel is hardly possible. 3. This part of the skull is peculiarly liable to be broken.

It has been shown that the artery may be ruptured by force sufficient to occasion detachment of the dura mater, but not great enough to fracture the skull. Next to the middle meningeal the most frequent source of extra-dural hæmorrhage is the lateral sinus. In referring to the attachment of the dura mater to the cranium, we find that it.is intimately adherent to the bone forming the interior of the wall of the skull, therefore this variety of hæmorrhage in this situation is barely possible. Over the vault of the cranium its attachments are comparatively loose, except along the lines of the sutures. Sir C. Bell has pointed out that the dura mater of the vault may be separated from the bone by the vibration produced by a blow. Strike the skull of the subject with a heavy mallet; on dissecting, you find the dura mater to be shaken from the skull at the point struck. Repeat the experiment on another subject, and inject the head minutely with size injection, and you will find a clot of injection lying between the skull and the dura mater at the part struck, and having an exact resemblance to the coaglum found after violent blows on the head. Tillaux has demonstrated, that the adhesions between the dura mater and the bone are particularly weak in the temporal fossa, the most usual site of meningeal hæmorrhage.

In the diagnosis of extra-dural hæmorrhage the following points are to be observed:

Mental Condition.—May be normal, or there may be cerebral irritation. Unconsciousness complete or incomplete, or coma.

Condition of Pupils.—May both respond to light normally. May both be dilated and show no response; or one may be widely dilated and the other normal. When the dilated pupil corresponds to the injured side, it is caused, as pointed out by Hutchinson, by the pressure of a large clot, extending deeply down into the base of the skull, on the cavernous sinus, leading to fullness of the vessels, with protrusion of the eyeball and dilatation of the pupil. It is also accounted for by compression of the oculo-motor nerve by the clot.

Respiration.—May have stertorous breathing, Cheyne-Stokes respiration, or cyanosis.

Pulse.—Little changed, or rapid and feeble, depending largely on the severity of the concussion; or slow and full, depending upon the severity of the compression.

Limbs.—May present any of the following conditions: Hemiplegia, well or but little marked. On the same side as the one injured, indicating hæmorrhage on the opposite side; monoplegia, paralysis, twitching, convulsions, rigidity (spastic).

Scalp.—Presence of contusion, or bogginess due to the injury; the latter also due to leakage from within the cranium through a fissured fracture.

The stages presented by a typical case of extra-dural hæmorrhage are three:

I. Complete or partial unconsciousness, the result of the concussion or shock, caused by the fall or blow, as the case may be.

II. Consciousness or lucidity. This stage may vary in length from a few minutes to several hours. "Is present in about one-half of the cases," says Jacobson.

A very large hæmorrhage may produce compression at once, as I have observed, verifying my observation by post-mortem examination. Compression may also come on immediately, caused by coexisting depression of bone, injury to the brain, and alcoholism.

III. Compression.

CASE I.—A. P., aged eighteen years, was admitted to the German Hospital, December 17, 1886, with pistol-shot wound of the left temporal region, the history of the case being as follows: While A. P. was playing with several companions, one of them with a single barrelled 22-calibre pistol, attempted to shoot over his head, when the hand in which the pistol was held being about twelve inches away from the side of the head, was drawn down by another companion, and the pistol accidentally discharged.

Upon probing for the bullet, the external table of the skull, at the point corresponding to the wound in the scalp, was found denuded of its periosteal covering and slightly roughened. The patient at the time of admission presented no head symptoms, was perfectly conscious, and suffered no more pain than usually accompanies wounds. The wound was dressed antiseptically, and the patient put to bed. Upon making my visit throug hthe wards on the following morning, December 18th, I found that he was aphasic. I advised operative interference, to which he gave his consent.

He was taken into the clinic, and in the presence of the class I trephined. The outer wall of the cranium, at a point measuring two inches posterior to the external angular process of the frontal bone and two inches above the zygomatic arch, was exposed by dissecting up a horseshoe-shaped flap, from the scalp with its convexity directed downwards and backwards. This was the point of the skull with which the ball came in contact, and being immediately over the base of the second and third frontal convolutions (the portion of the hemisphere in relation to the ascending limb of the fissure of Sylvius, and the lower extremities of the fissure of Rolando, Broca's convolution, or the region of motor speech). The roughening which was detected at this point was caused by a small portion of the bullet imbedded in the outer table of the skull. The remaining part of the bullet was found one inch behind and below this point. It lay beneath the temporal muscle and was somewhat flattened. The trephine included the roughened portion of the skull. Upon the removal of the button of bone, which demonstrated that the internal table was fractured, but with no depression of the fragments, was seen a clot, evidently the result of a rupture of the posterior of the two branches of the anterior division of the middle meningeal artery; this was removed, and as there was no further bleeding, the flap was adjusted, and the wound drained with catgut. The patient made a complete and uninterrupted recovery. The aphasic symptoms disappeared shortly after the operation.

CASE II.—J. E., aged thirty-four years, white, was admitted to the German Hospital, September 23, 1889, at 5 P. M., when he stated that he had fallen down a hatchway, a distance of twenty feet.

His condition on admission was as follows: Perfectly conscious, but a little dull mentally; he was able to narrate the occurrence of the accident very intelligently. Respiration 14, temperature 97; slight lacerated scalp wound of the right side over the parietal eminence; also contused and lacerated wound of the left elbow, opening up the capsule of the joint. He had perfect control of the bladder, being able to pass his urine shortly after he was admitted to the hospital. The wounds were dressed and the patient put to bed.

6 P. M.—Dr. Michel, the resident surgeon, was sent for to see the patient as he was quite restless, showing some evidence of cerebral irritation.

7.30 P. M.—Respiration somewhat noisy and labored, and this condition was shortly followed by a slight twitching of the right leg, arm and face, which continued with very little change until 8 P. M., when it was followed by convulsions, commencing in the right leg and becoming rapidly general.

I was sent for, seeing the patient at 9 P. M. I immediately explored the scalp wound, but could find no evidence of fracture. I removed a button of bone, two inches in diameter, from the left side of the skull, the centre of the button corresponding to that of the scalp wound, which I believed to be the point of the greatest intensity of shock from the fall, and where I therefore expected to find the maximum amount of separation of the dura mater, and consequently the largest amount of clotted blood, in the the event that I was correct in my diagnosis of extensive but circumscribed extra-dural hæmorrhage. Upon the removal of the button of bone, clotted blood immediately commenced to escape through the trephine opening. I removed all of the clot, leaving a space between the skull and the dura mater, which held four ounces and one drachm of a 1–2000 bichloride solution. Rubber drainage tube, of medium size, was introduced into the bony opening, and brought out at the lower angle of the scalp wound. The wound was adjusted with silver wire sutures, and the head dressed. The patient lived but a short time after the operation, not having reacted.

Autopsy made the following day, December 26, 11 A. M. The brain and cranial cavity alone examined. Upon the removal of the calvarium the surface of the dura mater was free of blood and otherwise normal, except at the point of separation already referred to. Brain removed. Dura mater lining sides and base of skull removed, when was seen a fissured fracture starting in left parietal bone immediately below opening made at operation, and extending into the floor of the middle cerebral fossa, involving only the outer half of same. Examination of brain showed it to be perfectly normal except at three points on the basilar aspect of the temporo-sphenoidal lobe; these were evidently seats of contusion, involving only the gray matter, as shown by making sections of the brain. No further evidence of cranial hæmorrhage or other lesions.

CASE III.—Harvey Kitchen, twenty-three years old, white, was admitted to the German Hospital, December 19, 1889, 12.30 P. M., having met with an accident. He had fallen a distance of fifteen feet through an elevator, landing on the top of his head.

His condition upon admission, as described by the resident surgeon, Dr. Gerlach, was as follows: Complete unconsciousness, pupils responding to light, conjunctival reflexes active, respiration 24, pulse 100, temperature 99°. The scalp was much swollen and boggy over the whole of the left side and vertex, with lacerated wound of the right ear at the junction of the concha with scalp. The urine was drawn; quantity small, normal in reaction and color; chemical tests for albumen and sugar negative. The patient remained in the above condition twenty minutes, when he regained partial consciousness for about five minutes; he was then seized with a general epileptiform convulsion, lasting one minute. The convulsion, as described by the Sister, was thought to have commenced in the right leg, but it became general so soon that she could not be certain. After the convulsion the patient could not be aroused fully, but showed some evidence of consciousness when spoken to. His breathing was embarrassed, the pulse full and strong. After an interval of ten minutes he was seized with another convulsion, lasting about double the length of the first, and described by a second Sister present as corresponding with that of the first seizure; but she too was in doubt about the spasm commencing in the right leg, as it became general so soon. Dr. Gerlach was sent for, but arrived too late to witness the convulsive seizures. The patient was now intensely cyanosed, respirations slow, deep, and stertorous, pulse slow and full. Upon my arrival at the hospital, but a moment or two later, very fortunately, I found his condition as above noted. Examination of the right side demonstrated the limbs to be slightly spastic, the left paretic.

As there was but little doubt in my mind that the condition was one of intra-cranial hæmorrhage, and most probably of the extra-dural variety, there having been an interval of consciousness between the reaction from the concussion or shock and the development of convulsions, I immediately prepared to trephine over the anterior branch of the middle meningeal artery. The scalp was quickly prepared for a strictly antiseptic operation, and ether administered. A large horse-shoe flap, including all the layers of the scalp, with its convexity directed downward and backward, was turned up on the left side by carrying an incision from directly behind the external angular process of the frontal bone to above and behind the parietal eminence; then was seen a fissured fracture following the coronal suture. To trace it throughout its entire length, two further incisions were made, one following the line of the coronal suture, the other from the termination of the latter, a short distance over the right parietal bone, when these flaps were reflected forward and backward, almost the entire vertex was laid bare.

In the subaponeurotic space and infiltrating the areolar tissue of the scalp was an extensive extravasation of blood. The fracture extended from the beginning of the coronal suture to about one and a half inches beyond the sagittal suture; from this point a fissure extended obliquely downward and backward into the right parietal bone, also one obliquely forward, and to the left, involving both the right and left frontal bones, stopping short of the supra-orbital margin. There was some bleeding from beneath the bone, through the line of separation of the coronal suture, most marked on the left side. With a medium-sized trephine, an inch and a half in diameter, a button of bone was removed at a point one inch and a half behind the external angular process of the frontal bone; and one and three-quarter inches above the zygoma, when the anterior branch of the middle meningeal artery was exposed and its ends ligated with catgut. The bleeding not being entirely arrested, with a pair of Hopkins' modification of the rongeur forceps the opening was enlarged in the direction of the groove in the squamous portion of the temporal bone, through which passes the posterior branch of the above vessel, when it was plainly to be seen that the source of the remaining hæmorrhage was most probably this branch near its point of origin; the opening was therefore enlarged in the direction of the spinous foramen of the sphenoid bone, and after cutting away bone, to the extent of about one-half inch, the vessel was seen to be torn and bleeding freely. Both ends were tied with catgut, after which the hæmorrhage ceased. The cavity occasioned by the separation of the dura mater was washed out with a 1-2000 bichloride solution.

I removed a second button of bone, three-quarters of an inch in diameter, from a point about three-quarters of an inch to the left of the sagittal suture, and about one inch posterior to the separated coronal suture, this corresponding to the upper and posterior margin of the cavity caused by the separation of the dura mater. My object in doing this was to enable me to pass catgut-drainage through this opening and out of the one first made, this securing a perfect outlet to any liquid that would otherwise have a tendency to collect in the cavity. Through this last opening I incised the dura mater and exposed the sub-dural space, to determine whether or not there was either the second or third variety of intra-cranial hæmorrhage associated with the extra-dural which I had already checked. This proved negative. The incision of the dura mater was closed with catgut suture. The end of a rubber drainage-tube, one-quarter of an inch in diameter, was placed in the lower and anterior of the two openings made in the wall of the skull, and brought out at the lower angle of the scalp-wound, where it was fixed by a silver wire suture, loosely twisted. A second rubber drainage-tube, the same size as the above, was placed beneath the scalp-flaps, above the two trephine-openings, and brought out in front and behind, where it was fixed by a silver wire suture. The flaps were now completely adjusted and held in apposition by interrupted silver wire sutures. Through the tubes a 1-2000 solution of bichloride of mercury was passed, and the wound dressed antiseptically. A hypodermic injection of one-eighth of a grain of morphia was given to the patient, when he was removed from the operating-table. Dry heat was applied to the body and an ice-bag to the head. He reacted well, and slept for four hours after the operation, when he awoke and was fairly rational. Being now able to swallow, he was given milk diet and ordered one-quarter of a grain of calomel, with two grains of Dover's powder every two hours. At 8 P. M., six and one-half hours after the operation, he was perfectly quiet and entirely rational. Pulse 96, respiration 28, and temperature 100°; pupillary reaction normal. He was able to execute the ordinary movements with his extremities; said he felt pretty comfortable, although he had some pain in his head; during the night was somewhat restless.

December 20th.—Condition unchanged from that of previous evening.

At 3.30 A. M., December 21st, he had a slight convulsion, beginning in right upper extremity, with flexion of hand upon wrist; then forearm on arm; when it immediately became general; this lasted about one-half minute. At 5.30 A. M. had second convulsion similar to the above and lasting about the same length of time. Between and after these convulsions he slept.

8 A. M.—Condition of patient good, with the exception of pulse, which was full and bounding. In addition to the calomel and Dover's powder, tincture of verat. virid., two drops, and bromide of sodium, twenty grains, was ordered every two hours.

December 23d.—Dressings changed; no pus; drainage-tubes clear; tincture of verat. virid. and bromide of sodium stopped.

December 26th.—Calomel and Dover's powder stopped since slight mercurial stomatitis had developed, for which a gargle of chlorate of potassium and listerine were given. From this on the recovery was uninterrupted.

[This patient was exhibited in perfect health to the Society.]

In answer to the question, what led me to trephine in these cases, I will simply make a summary of the main symptoms of each:

CASE I.—(1) The injury to the outer table of the skull, as demonstrated by the probe, near the point corresponding to the location of the anterior branch of the middle meningeal artery; (2) aphasia coming on a few hours after the accident.

CASE II.—(1) Circumscribed contusion of the scalp; (2) period of consciousness following the accident; (3) evidence of cerebral irritation with twitchings of the side of the face and of the extremities opposite to the side injured; (4) convulsions commencing on the side opposite to that injured; (5) coma; (6) paralysis.

CASE III.—(1) Unconsciousness; (2) pupils responding to light; (3) conjunctival reflexes active; (4) period of partial consciousness; (5) convulsions.

In closing this paper, I would not have you understand, from what was said in the beginning, that I am opposed to trephining for focal epilepsy, brain tumors, etc. I am not; but I do not consider the results in these cases as brilliant as in cases of extra-dural hæmorrhage.

As the subject of head injuries, both in their immediate and remote effects, is of interest to the neurologist as well as to the surgeon, it may not be out of place to tabulate my rules for trephining in this class of cases.

In this paper I have given the conditions for which I trephine when I suspect extra-dural hæmorrhage.

I trephine also in simple depressed fracture of skull, with or without symptoms of compression.

In compound depressed fractures, with or without symptoms of compression.

In punctured or incised fractures.

In fractures of the orbital plate of the frontal bone.

In punctures of the cribriform plate of the ethmoid bone, applying trephine to roof of orbit at the inner angle, thus opening up the most dependent part of the anterior cerebral fossa, and thereby favoring drainage, which is a chief indication in this class of injuries.

For foreign bodies in the brain.

For impacted fractures.

In gunshot injuries of skull.

In contusion of the scalp, simulating depressed fracture; here exposing the cranium at the seat of contusion, when, if depressed fracture is found, I trephine; and also, if a fissured fracture, if there is any hæmorrhage through the line or lines of fracture.